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1. Heat studies with the highly resistant bacterial spore isolated from Cape Kennedy soil (Bacillus, sp. 125-48A; ATCC Bacillus, sp. no. 27380, Q.R. #33-36,38) were continued and the D_{130C} was determined. The spore suspension used was AK+8/27-9/16 (Q.R. #36; D_{125C} = 139 hr) and the methodology used in the trials was the same as previously described (Q.R. #36). Duplicate runs were conducted employing 8-½" x ½" inoculated stainless steel strips suspended in the 130 C forced air oven at each interval. Figure 1 shows the composite results (a total of 16 strips per interval). Ranges of the number of survivors per strip are shown, and the D_{130C} calculated from the best fit line of mean values at each interval (excluding N_0) was 54 hr. Preliminary trials at 135 C have indicated that extinction of the population ($N_0 = 5.0 \times 10^2$) occurs between 72 and 96 hr. Further studies will be done at higher temperatures so that a Z-value can be obtained.

2. The interior surfaces of the Command Module (CM) of the Apollo 17 spacecraft were studied for microbial contamination during assembly and testing at the Kennedy Space Center (KSC). Swab samples were taken on predetermined surfaces of the CM at pre-flight (T-9 hr) at KSC and post-flight on the recovery vessel. Pre-flight samples were taken by a member of the astronaut backup crew and post-flight samples were taken by a staff member of the Manned Space Center (MSC) present on the recovery vessel. Samples were taken from the same locations as for pre-flight, kept at 0 to 4 C, transported to the Planetary Quarantine Laboratory at Cape Kennedy, and were assayed within 28 hr after being taken.

   Table 1 shows the results of the individual surface sites on the CM sampled on pre- and post-flight. Lower levels of microbial contamination were detected on most sites at post-flight than on pre-flight. These results are similar to those obtained on the pre- and post-flight samples of Apollo 16 (Q.R. #38). The reason for the decrease in microbial contamination on post-flight samples is not clear. Loss of cell viability in transporting to Cape Kennedy prior to assay could be a possible explanation.

   Average levels of microbial contamination on the pre-flight samples were greater than those encountered on the CM of either Apollo 15 or 16 when identical sites were compared (Table 2). For purposes of comparison, the fifteen sampling sites in the CM were combined, and the mean number of aerobic mesophilic microorganisms per square foot was determined for pre-flight samples. This number, 1.6×10^5 per square foot, is one log higher than has been observed for all previous Apollo CM (Q.R. #35,38) samplings.

   A comparison of the microbial contamination detected on the individual sites of the CM of Apollo 17 on post-flight was found to be similar to those observed for Apollo 16, but lower than Apollo 15 (Table 3).

   A total of 500 microorganisms were isolated from the CM of Apollo 17. Of these isolates, 250 were obtained from the interior surfaces of the CM at pre-flight and 250 from the post-flight sampling periods, respectively. These isolates are being identified and results will be reported

during the next quarter.

3. The study to determine the thermal resistance of naturally occurring airborne bacterial spores (Q.R. #35-39) using the heating times of 2, 4, 6, and 8 hr at 125 C was concluded. Table 4 shows the completed data from experiments 1 through 42. A summary of all teflon experiments conducted at 125 C according to heating time is shown in Table 5. Eight hours was the longest heating time yielding survivors. The D_{125C} values were calculated using the FN-MPN technique of Pflug and Schmidt and ranged from 25 to 126 minutes.

   Six thermal experiments were conducted at 113 C using heating times of 6, 12, 18, and 24 hr. Techniques used were identical to the 125 C experiments except for the differences in temperature and heating intervals. Table 6 shows the results of these experiments. Survivors were recovered at all of the heating intervals used. Table 7 shows a summary of all teflon experiments conducted at 113 C. The D_{113C} values were calculated using the FN-MPN technique and ranged from 170 to 451 minutes.

   The wide range of D values observed in each of these experiments suggested that the FN-MPN values did not fit a straight line passing through the initial population as would be expected if the population were homogeneous. However, it was apparent from a plot of these values, as shown in Figures 2 and 3, that both at 125 C and 113 C FN-MPN survivor values described straight lines representing D values considerably higher than any calculated using the technique of Pflug and Schmidt. The best fit lines through these two sets of four MPN values represent a D_{125C} value of 6.3 hr and a D_{113C} of 14.4 hr respectively. These findings are in agreement with previous experience in which naturally occurring heterogeneous spore populations exposed to dry heat show an initial rapid decline in numbers followed by a much slower rate of destruction which is characteristic of the most resistant portion of the initial population.

   A listing of the total numbers of heat survivors and their identification is shown in Table 8.

4. The study for the evaluation of a terminal sterilization process for unmanned lander spacecraft is continuing. All equipment has been installed and calibrated. To prevent contamination of samples during removal from the oven and processing, two laminar flow clean benches were joined together and enclosed within a plastic canopy. In essence, this arrangement created a small clean room around the area where samples might otherwise be exposed to environmental microbial contamination. Thermal inactivation experiments are presently being conducted. Results of these experiments will be reported in the next quarter.

5. The numbers and types of fungi present on spacecraft surfaces have been determined in the past from TSA pour plates used to determine total microbial load. Since this technique is not one normally used to isolate fungi, a study was undertaken to compare kinds and number of fungi from TSA pour plates with those isolated on other media.

The samples used in the study were taken from the IU and S4B modules of the Apollo 16 spacecraft using the swab-rinse technique as per NASA Standard Procedures. Fifteen sites in each module were sampled twice with one week between samples. Each swab was placed in 5 ml of rinse solution and plated in duplicate on each of the following media: 1 ml on TSA pour plate, 0.2 ml on TSA spread plate, 0.2 ml on Mycophil + Chloromycetin spread plate, 0.2 ml on Cornmeal + Chloromycetin spread plate, 0.2 ml on Mycophil + Chloromycetin and Cycloheximide spread plate. All plates were incubated at room temperature except the TSA pour plates which were incubated at 37 C. Counts were made after 7 days of incubation. Some plates were held for as long as three weeks to observe for slow developing colonies. Colonies were picked at various times after 7 days and up to three weeks depending on the amount of growth on the plates. A total of 330 colonies were isolated.

The average number of fungi per ml for each type of medium on each module is shown in Table 9. All media except Mycophil + Chloromycetin and Cycloheximide were compared to TSA pour plates for quantitative isolation of fungi and they all showed significantly higher average counts than the TSA pour plates. There was no significant difference in the number of fungi isolated between Mycophil + Chloromycetin and TSA spread plates or between Mycophil + Chloromycetin and Cornmeal + Chloromycetin spread plates. In the S4B samples, there was no significant difference between Cornmeal + Chloromycetin and TSA spread plates; however, in the IU there were significantly more fungi isolates on the Cornmeal + Chloromycetin plates than the TSA spread plates. In both modules, the highest counts were observed on the Cornmeal + Chloromycetin plates. The Mycophil + Chloromycetin and Cycloheximide plates were not compared for quantitative recovery since Cycloheximide inhibits rapidly growing fungi. These plates were observed for possible slow growing fungi which could be missed on the other media.

The 330 isolates are being identified by Dr. Brandsberg of the Kansas City Laboratories. When complete, these identifications will be compared according to the media from which isolated to see if any qualitative differences exist between the isolation media.

TABLE 1. COMPARISON OF THE PRE- AND POST-FLIGHT MICROBIOLOGICAL RESULTS OF THE INDIVIDUAL SURFACE SITES SAMPLED IN APOLLO 17 COMMAND MODULE

Areas Sampled	Mean No. Microorganisms Per Square Inch	
	T-9 Hrs	Post-Flight
Girth Shelf - Right	1.5×10^3	7.5×10^0
Girth Shelf - Left	2.1×10^3	4.8×10^1
Waste Disposal Rim (Compartment No. 5)	2.6×10^3	1.7×10^2
Top Flight Recorder (Panel A3)	2.7×10^3	Sample not taken
Reaction Jet Control (On-Off)	1.7×10^3	3.5×10^2
Exposed Floor by Hatch	6.7×10^2	6.0×10^2
Ordeal Cable Stowage (Top)	3.8×10^0	1.0×10^3
Vertical Couch Support Beam - Right	1.3×10^2	3.0×10^1
Vertical Couch Support Beam - Left	1.0×10^1	1.8×10^1
Horizontal Couch Support Beam - Right	2.3×10^3	6.0×10^2
Horizontal Couch Support Beam - Left	1.0×10^3	1.1×10^2
Ledge Below Left Window (Panel 325)	1.7×10^3	2.8×10^2
Right Control Handle (RCH)	9.6×10^2	6.0×10^1
Left Control Handle (LCH)	3.6×10^2	4.0×10^1
Drink Gun[1]	1.4×10^3	4.5×10^2

[1]Total number of microorganisms recovered from sample.

TABLE 2. COMPARISON OF THE PRE-FLIGHT MICROBIOLOGICAL RESULTS OF THE INDIVIDUAL SURFACE SITES SAMPLED IN APOLLO 15, 16, AND 17 COMMAND MODULE

Areas Sampled	Mean No. Microorganisms Per Square Inch[1]		
	Apollo 15	Apollo 16	Apollo 17
Girth Shelf - Right	7.5×10^1	2.5×10^2	1.5×10^3
Girth Shelf - Left	1.3×10^2	8.5×10^2	2.1×10^3
Waste Disposal Rim (Compartment No. 5)	8.8×10^1	9.8×10^1	2.6×10^3
Top Flight Recorder (Panel A3)	1.3×10^2	1.5×10^2	2.7×10^3
Reaction Jet Control (On-Off)	5.0×10^1	8.6×10^1	1.7×10^3
Exposed Floor by Hatch	1.5×10^2	2.4×10^2	6.7×10^2
Ordeal Cable Stowage (Top)	5.8×10^1	6.2×10^2	3.8×10^0
Vertical Couch Support Beam - Right	2.5×10^0	8.7×10^0	1.3×10^2
Vertical Couch Support Beam - Left	0.0	8.7×10^0	1.0×10^1
Horizontal Couch Support Beam - Right	3.3×10^2	1.4×10^2	2.3×10^3
Horizontal Couch Support Beam - Left	1.5×10^2	2.4×10^3	1.0×10^3
Ledge Below Left Window (Panel 325)	2.3×10^1	9.8×10^2	1.7×10^3
Right Control Handle (RCH)	0.0	3.3×10^1	9.6×10^2
Left Control Handle (LCH)	0.0	3.8×10^1	3.6×10^2
Drink Gun[2]	0.0	1.5×10^3	1.4×10^3

[1] Aerobic mesophilic count.
[2] Total number of microorganisms recovered from sample.

TABLE 3. COMPARISON OF THE POST-FLIGHT MICROBIOLOGICAL RESULTS OF THE INDIVIDUAL SURFACE SITES SAMPLED IN APOLLO 15, 16 AND 17 COMMAND MODULE

Areas Sampled	Mean No. Microorganisms Per Square Inch[1]		
	Apollo 15	Apollo 16	Apollo 17
Girth Shelf - Right	4.5×10^1	4.5×10^1	7.5×10^0
Girth Shelf - Left	1.9×10^3	2.9×10^2	4.8×10^1
Waste Disposal Rim (Compartment No. 5)	1.7×10^4	5.3×10^2	1.7×10^2
Top Flight Recorder (Panel A3)	5.0×10^0	4.8×10^1	Sample not taken
Reaction Jet Control (On-Off)	6.0×10^1	7.5×10^0	3.5×10^2
Exposed Floor by Hatch	TNTC[3]	2.0×10^1	6.0×10^2
Ordeal Cable Stowage (Top)	2.1×10^4	0.0	1.0×10^3
Vertical Couch Support Beam - Right	9.8×10^1	1.0×10^2	3.0×10^1
Vertical Couch Support Beam - Left	1.8×10^2	1.2×10^2	1.8×10^1
Horizontal Couch Support Beam - Right	2.0×10^2	3.5×10^1	6.0×10^2
Horizontal Couch Support Beam - Left	Sample not taken	8.6×10^2	1.1×10^2
Ledge Below Left Window (Panel 325)	2.6×10^4	2.5×10^0	2.8×10^2
Right Control Handle (RCH)	2.9×10^2	0.0	6.0×10^1
Left Control Handle (LCH)	4.0×10^1	2.5×10^0	4.0×10^1
Drink Gun[2]	5.2×10^3	2.7×10^2	4.5×10^2

[1]Aerobic mesophilic count.
[2]Total number of microorganisms recovered from sample.
[3]TNTC - To numerous to count.

TABLE 4. THERMAL RESISTANCE OF NATURALLY OCCURRING AIRBORNE BACTERIAL SPORES COLLECTED ON EXPOSED TEFLON RIBBONS - CAPE KENNEDY - 125 C

Experiment Number	Area	Total Count	N_0 Spores	Molds	Survivors	Identification
1	MSOB - I	5.4×10^3	2.4×10^2	2.4×10^2	3 hr. - 3/6	B. circulans-2, Atypical Bacillus
					6 hr. - 0/6	
					9 hr. - 0/6	
					12 hr. - 0/6	
2	"	4.0×10^3	1.2×10^2	8.0×10^1	3 hr. - 0/6	
					6 hr. - 0/6	
					9 hr. - 0/6	
					12 hr. - 0/6	
3	"	3.1×10^3	1.4×10^2	1.6×10^2	3 hr. - 0/6	
					6 hr. - 0/6	
					9 hr. - 0/6	
					12 hr. - 0/6	
4	"	4.1×10^3	4.3×10^2	1.6×10^2	3 hr. - 0/6	
					6 hr. - 1/6	Atypical Bacillus
					9 hr. - 0/6	
					12 hr. - 0/6	
5	MSOB - II	4.9×10^3	2.7×10^2	3.6×10^3	1 hr. - 5/6	B. sphaericus-2, B. lentus, B. firmus, Atypical Bacillus
					2 hr. - 3/6	B. cereus, B. firmus, Atypical Bacillus
					3 hr. - 1/6	B. polymyxa
					4 hr. - 1/6	B. subtilis
6	"	3.8×10^3	2.6×10^2	2.6×10^3	1 hr. - 4/6	B. lentus-2, B. subtilis, Atypical Bacillus
					2 hr. - 3/6	B. polymyxa, B. pantothenticus, Atypical Bacillus
					3 hr. - 0/6	
					4 hr. - 2/6	B. lentus-2

TABLE 4. THERMAL RESISTANCE OF NATURALLY OCCURRING AIRBORNE BACTERIAL SPORES COLLECTED ON EXPOSED TEFLON RIBBONS - CAPE KENNEDY - 125 C (Continued)

Experiment Number	Area	Total Count	N_0 Spores	Molds	Survivors	Identification
7	MSOB - II	1.4×10^3	1.4×10^2	4.8×10^2	1 hr. - 1/6 2 hr. - 0/6 3 hr. - 0/6 4 hr. - 0/6	B. sphaericus
8	"	4.0×10^2	4.0×10^1	2.4×10^2	1 hr. - 0/6 2 hr. - 0/6 3 hr. - 0/6 4 hr. - 0/6	
9	"	4.8×10^2	5.6×10^1	8.0×10^1	1 hr. - 0/6 2 hr. - 0/6 3 hr. - 0/6 4 hr. - 0/6	
10	"	5.6×10^2	1.5×10^2	1.6×10^2	2 hr. - 0/6 4 hr. - 0/6 6 hr. - 0/6 8 hr. - 0/6	
11	"	1.3×10^3	2.1×10^2	4.0×10^2	2 hr. - 0/6 4 hr. - 0/6 6 hr. - 0/6 8 hr. - 0/6	
12	"	6.4×10^2	8.8×10^1	2.4×10^2	2 hr. - 0/6 4 hr. - 0/6 6 hr. - 0/6 8 hr. - 0/6	
13	"	1.4×10^3	1.4×10^2	9.6×10^2	2 hr. - 0/6 4 hr. - 0/6 6 hr. - 0/6 8 hr. - 0/6	

TABLE 4. THERMAL RESISTANCE OF NATURALLY OCCURRING AIRBORNE BACTERIAL SPORES COLLECTED ON EXPOSED TEFLON RIBBONS - CAPE KENNEDY - 125 C (Continued)

Experiment Number	Area	Total Count	N_0 Spores	Molds	Survivors	Identification
14	MSOB - II	1.1×10^3	1.3×10^2	2.4×10^2	2 hr. - 3/6	B. circulans, Actinomycete, Atypical Bacillus
					4 hr. - 1/6	Actinomycete
					6 hr. - 0/6	
					8 hr. - 0/6	
15	"	4.0×10^2	5.6×10^1	1.6×10^2	2 hr. - 1/6	B. sphaericus
					4 hr. - 1/6	B. sphaericus
					6 hr. - 0/6	
					8 hr. - 0/6	
16	"	4.0×10^2	7.2×10^1	1.6×10^2	2 hr. - 0/6	
					4 hr. - 0/6	
					6 hr. - 0/6	
					8 hr. - 0/6	
17	"	6.4×10^2	6.4×10^1	3.2×10^2	2 hr. - 0/6	
					4 hr. - 0/6	
					6 hr. - 0/6	
					8 hr. - 0/6	
18	"	1.5×10^3	2.1×10^2	4.0×10^2	2 hr. - 1/6	B. sphaericus
					4 hr. - 0/6	
					6 hr. - 2/6	B. circulans, Atypical Bacillus
					8 hr. - 0/6	
19	"	4.8×10^2	4.8×10^1	8.0×10^1	2 hr. - 0/6	
					4 hr. - 0/6	
					6 hr. - 0/6	
					8 hr. - 0/6	
20	"	1.9×10^3	2.2×10^2	4.0×10^2	2 hr. - 2/6	Actinomycete, B. lentus
					4 hr. - 0/6	
					6 hr. - 1/6	B. lentus
					8 hr. - 1/6	B. sphaericus

TABLE 4. THERMAL RESISTANCE OF NATURALLY OCCURRING AIRBORNE BACTERIAL SPORES COLLECTED ON EXPOSED TEFLON RIBBONS - CAPE KENNEDY - 125 C (Continued)

Experiment Number	Area	Total Count	N_0 Spores	Molds	Survivors	Identification
21	MSOB - II	2.4×10^2	5.6×10^1	8.0×10^1	2 hr. - 0/6 4 hr. - 0/6 6 hr. - 0/6 8 hr. - 0/6	
22	"	5.6×10^2	8.0×10^1	8.0×10^1	2 hr. - 0/6 4 hr. - 0/6 6 hr. - 0/6 8 hr. - 0/6	
23	"	7.2×10^2	8.0×10^1	2.4×10^2	2 hr. - 0/6 4 hr. - 0/6 6 hr. - 0/6 8 hr. - 0/6	
24	"	9.6×10^2	1.1×10^2	2.4×10^2	2 hr. - 1/6 4 hr. - 0/6 6 hr. - 0/6 8 hr. - 0/6	B. lentus
25	"	2.9×10^3	5.2×10^2	8.8×10^2	2 hr. - 1/6 4 hr. - 1/6 6 hr. - 0/6 8 hr. - 0/6	B. sphaericus B. sphaericus
26	"	2.5×10^3	8.2×10^2	3.2×10^2	2 hr. - 3/6 4 hr. - 0/6 6 hr. - 0/6 8 hr. - 3/6	B. subtilis, B. lentus-2 B. sphaericus-2, Lost in process
27	"	2.0×10^3	6.6×10^2	4.0×10^2	2 hr. - 1/6 4 hr. - 1/6 6 hr. - 0/6 8 hr. - 1/6	Lost in process Lost in process Actinomycete

TABLE 4. THERMAL RESISTANCE OF NATURALLY OCCURRING AIRBORNE BACTERIAL SPORES COLLECTED ON EXPOSED TEFLON RIBBONS - CAPE KENNEDY - 125 C (Continued)

Experiment Number	Area	Total Count	N_0 Spores	Molds	Survivors	Identification
28	MSOB - II	3.2×10^3	2.3×10^2	3.2×10^2	2 hr. - 3/6	B. firmus, B. subtilis, B. polymyxa
					4 hr. - 1/6	Actinomycete
					6 hr. - 1/6	B. sphaericus
					8 hr. - 0/6	
29	"	1.8×10^3	2.1×10^2	7.2×10^2	2 hr. - 2/6	Actinomycete, B. polymyxa
					4 hr. - 1/6	Atypical Bacillus
					6 hr. - 0/6	
					8 hr. - 0/6	
30	"	1.0×10^3	1.7×10^2	1.6×10^2	2 hr. - 3/6	Actinomycete-2, Atypical Bacillus
					4 hr. - 1/6	B. firmus, B. sphaericus, Atypical Bacillus
					6 hr. - 0/6	
					8 hr. - 0/6	
31	"	9.6×10^2	1.2×10^2	2.4×10^2	2 hr. - 1/6	Actinomycete
					4 hr. - 0/6	
					6 hr. - 0/6	
					8 hr. - 0/6	
32	"	5.9×10^3	2.6×10^2	4.4×10^3	2 hr. - 3/6	B. lentus-2, Atypical Bacillus
					4 hr. - 1/6	B. lentus
					6 hr. - 0/6	
					8 hr. - 1/6	B. subtilis
33	"	2.8×10^3	4.0×10^2	1.4×10^3	2 hr. - 5/6	B. megaterium-3, B. pumilus, Atypical Bacillus
					4 hr. - 2/6	Actinomycete, B. lentus
					6 hr. - 2/6	Actinomycete, Atypical Bacillus
					8 hr. - 0/6	
34	"	3.4×10^3	4.6×10^2	1.5×10^3	2 hr. - 6/6	B. brevis-2, B. licheniformis-2, B. lentus, Atypical Bacillus
					4 hr. - 0/6	
					6 hr. - 1/6	B. lentus
					8 hr. - 0/6	

TABLE 4. THERMAL RESISTANCE OF NATURALLY OCCURRING AIRBORNE BACTERIAL SPORES COLLECTED ON EXPOSED TEFLON RIBBONS - CAPE KENNEDY - 125 C (Continued)

Experiment Number	Area	Total Count	N_0 Spores	Molds	Survivors	Identification
35	MSOB - II	2.2×10^3	2.0×10^2	1.4×10^3	2 hr. - 1/6	Atypical Bacillus
					4 hr. - 1/6	Atypical Bacillus
					6 hr. - 1/6	B. lentus
					8 hr. - 0/6	
36	"	1.2×10^3	2.0×10^2	4.0×10^2	2 hr. - 4/6	B. licheniformis-2, B. subtilis, B. lentus
					4 hr. - 1/6	B. lentus
					6 hr. - 1/6	B. laterosporus
					8 hr. - 0/6	
37	"	4.2×10^3	3.5×10^2	2.6×10^3	2 hr. - 2/6	Atypical Bacillus-2
					4 hr. - 3/6	B. brevis, Atypical Bacillus-2
					6 hr. - 1/6	Atypical Bacillus
					8 hr. - 1/6	B. coagulans
38	"	2.8×10^3	3.0×10^2	6.4×10^2	2 hr. - 5/6	Atypical Bacillus-2, B. brevis-2, Actinomycete
					4 hr. - 2/6	Atypical Bacillus, B. brevis
					6 hr. - 1/6	B. lentus
					8 hr. - 0/6	
39	MSOB - I	2.4×10^3	1.8×10^2	6.4×10^2	2 hr. - 3/6	B. subtilis, B. lentus, Atypical Bacillus
					4 hr. - 1/6	B. brevis
					6 hr. - 0/6	
					8 hr. - 0/6	
40	"	2.4×10^3	2.8×10^2	7.2×10^2	2 hr. - 5/6	B. licheniformis-2, B. subtilis-2, Atypical Bacillus
					4 hr. - 2/6	Atypical Bacillus, B. lentus
					6 hr. - 2/6	Actinomycete, B. brevis
					8 hr. - 0/6	

TABLE 4. THERMAL RESISTANCE OF NATURALLY OCCURRING AIRBORNE BACTERIAL SPORES COLLECTED ON EXPOSED TEFLON RIBBONS - CAPE KENNEDY - 125 C (Continued)

Experiment Number	Area	Total Count	N_0 Spores	Molds	Survivors	Identification
41	MSOB - I	3.5×10^3	1.8×10^2	2.2×10^3	2 hr. - 3/6 4 hr. - 1/6 6 hr. - 0/6 8 hr. - 0/6	B. subtilis, B. licheniformis-2 B. licheniformis
42	"	2.1×10^3	1.9×10^2	6.4×10^2	2 hr. - 3/6 4 hr. - 2/6 6 hr. - 2/6 8 hr. - 0/6	B. pumilus, B. subtilis, B. lentus B. brevis, Atypical Bacillus B. alvei, Atypical Bacillus

TABLE 5. SUMMATION OF RESULTS FROM TEFLON RIBBON EXPERIMENTS AT 125 C - CAPE KENNEDY

Heating Time (hr)	No. of Experiments	Total	N_0 Spores	No. Survivors Per Total No. Flasks	D Value (min)	Identification
1	5	2.7×10^3	1.0×10^2	10/30	25	B. lentus-3, B. sphaericus-3, B. subtilis, Atypical Bacillus-2, B. firmus
2	38	1.8×10^3	2.2×10^2	69/228	43	Atypical Bacillus-13, B. cereus, B. firmus-2, B. polymyxa-3, B. pumilus-2, B. pantothenticus, B. circulans, B. lentus-10, B. sphaericus-3, B. brevis-4, B. subtilis-8, B. megaterium-3, Actinomycete-8, Lost-2, B. licheniformis-8
3	9	2.6×10^3	2.2×10^2	4/54	52	B. polymyxa, B. circulans-2, Atypical Bacillus
4	38	1.8×10^3	2.2×10^2	26/228	74	B. firmus, B. subtilis, B. lentus-6, B. sphaericus-3, B. brevis-4, B. licheniformis, Actinomycete-3, Lost-1, Atypical Bacillus-9
6	37	2.0×10^3	2.2×10^2	16/222	104	Atypical Bacillus-5, B. circulans, B. lentus-4, B. sphaericus, B. laterosporus, Actinomycete-2, B. brevis, B. alvei
8	33	2.1×10^3	2.3×10^2	7/198	126	B. sphaericus-3, B. subtilis, B. coagulans, Lost-1, Actinomycete
9	4	4.0×10^3	2.0×10^2	0/24	---	----------
12	4	4.6×10^3	2.6×10^2	0/24	---	----------

TABLE 6. THERMAL RESISTANCE OF NATURALLY OCCURRING AIRBORNE BACTERIAL SPORES COLLECTED ON EXPOSED TEFLON RIBBONS - CAPE KENNEDY - 113 C

Experiment Number	Area	Total Count	N_0 Spores	Molds	Survivors	Identification
43	MSOB - I	2.2×10^3	1.8×10^2	4.0×10^2	6 hr. - 4/6	B. subtilis-2, B. licheniformis, Atypical Bacillus
					12 hr. - 2/6	B. subtilis, B. alvei
					18 hr. - 0/6	
					24 hr. - 1/6	B. cereus
44	"	2.7×10^3	2.8×10^2	5.6×10^2	6 hr. - 5/6	B. subtilis, B. licheniformis, B. lentus, Atypical Bacillus-2
					12 hr. - 4/6	B. lentus, B. firmus, B. licheniformis, Actinomycete, Atypical Bacillus
					18 hr. - 1/6	Atypical Bacillus
					24 hr. - 3/6	B. brevis, B. lentus, Atypical Bacillus
45	"	4.3×10^3	3.0×10^2	8.8×10^2	6 hr. - 6/6	B. licheniformis-2, B. subtilis-3, B. pumilus
					12 hr. - 4/6	B. lentus-2, Actinomycete, Atypical Bacillus
					18 hr. - 2/6	B. lentus, Atypical Bacillus
					24 hr. - 1/6	Atypical Bacillus
46	"	1.6×10^3	1.5×10^2	4.0×10^2	6 hr. - 6/6	B. brevis-2, B. lentus-2, Actinomycete, Atypical Bacillus
					12 hr. - 2/6	B. subtilis, Atypical Bacillus
					18 hr. - 1/6	B. lentus
					24 hr. - 0/6	
47	"	7.0×10^3	5.0×10^2	1.1×10^2	6 hr. - 6/6	B. licheniformis-2, B. lentus, B. brevis, B. subtilis, B. macerans
					12 hr. - 5/6	B. lentus-2, B. firmus, Atypical Bacillus-2
					18 hr. - 3/6	B. lentus-2, Actinomycete
					24 hr. - 0/6	

TABLE 6. THERMAL RESISTANCE OF NATURALLY OCCURRING AIRBORNE BACTERIAL SPORES COLLECTED ON EXPOSED TEFLON RIBBONS - CAPE KENNEDY - 113 C (Continued)

Experiment Number	Area	Total Count	N_0 Spores	Molds	Survivors	Identification
48	MSOB - I	3.6×10^3	3.0×10^2	1.3×10^3	6 hr. - 6/6	B. licheniformis-2, B. brevis-2, B. firmus, B. pumilus
					12 hr. - 2/6	B. lentus, Atypical Bacillus
					18 hr. - 1/6	B. lentus
					24 hr. - 0/6	

TABLE 7. SUMMATION OF RESULTS FROM TEFLON RIBBON EXPERIMENTS AT 113 C - CAPE KENNEDY

Heating Time (hr)	Total	N_O Spores	Molds	No. Survivors Per Total No. Flasks	D Value (min)	Identification
6	4.1×10^3	3.3×10^2	7.3×10^2	33/36	170	B. subtilis-7, B. licheniformis-8, Atypical Bacillus-4, B. pumilus-2, Actinomycete, B. brevis-5, B. macerans, B. firmus, B. lentus-4
12	3.4×10^3	2.6×10^2	7.4×10^2	19/36	284	B. subtilis-2, B. alvei, Atypical Bacillus-6, B. lentus-6, Actinomycete-2, B. firmus-2, B. licheniformis
18	3.5×10^3	3.1×10^2	7.7×10^2	8/36	351	Atypical Bacillus-2, B. lentus-5, Actinomycete
24	3.3×10^3	2.4×10^2	8.1×10^2	5/36	451	B. cereus, Atypical Bacillus-2, B. brevis, B. lentus

TABLE 8. IDENTIFICATION OF HEAT SURVIVORS FROM TEFLON RIBBONS AFTER EXPOSURE TO DRY HEAT AT 125 C AND 113 C

	Temperature	
Identification	125 C	113 C
B. subtilis	11	9
B. megaterium	3	0
B. licheniformis	9	9
B. cereus	1	1
B. firmus	3	3
B. pumilus	2	2
B. sphaericus	13	0
B. laterosporus	1	0
B. pantothenticus	1	0
B. coagulans	1	0
B. brevis	9	6
B. alvei	1	1
B. polymyxa	4	0
B. circulans	4	0
B. lentus	23	16
B. macerans	0	1
Atypical *Bacillus*	30	14
Actinomycete	14	4
Lost	4	0
TOTAL NUMBER OF SURVIVORS	134	66

TABLE 9. NUMBER* OF MOLDS ISOLATED PER ML OF SAMPLE ON VARIOUS MEDIA

	TSA Pour	TSA Spread	Mycophil and Chloromycetin	Cornmeal and Chloromycetin	Mycophil and Chloromycetin Cycloheximide
IU	.6	1.4	2.3	3.1	.1
S4B	.8	8.0	10.3	11.1	.3

*Average Number From 30 Plates

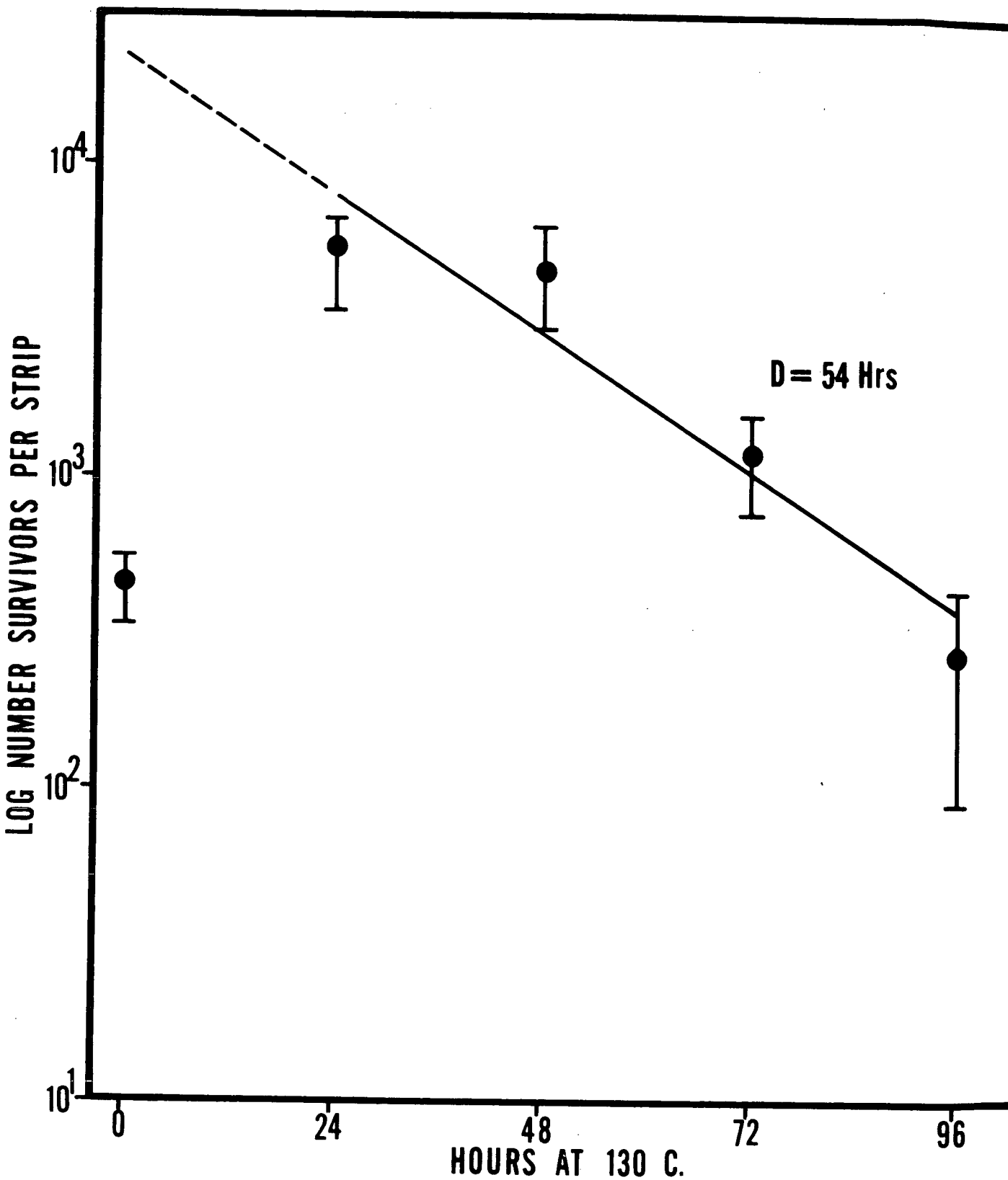

FIGURE 1. BACILLUS, SP., ATCC 27380, AK+8/27-9/16: DRY-HEAT INACTIVATION KINETICS AT 130 C

FIGURE 2. D_{125C} VALUES FOR NATURALLY OCCURRING AIRBORNE BACTERIAL SPORES ON TEFLON STRIPS EXPOSED IN THE MSOB

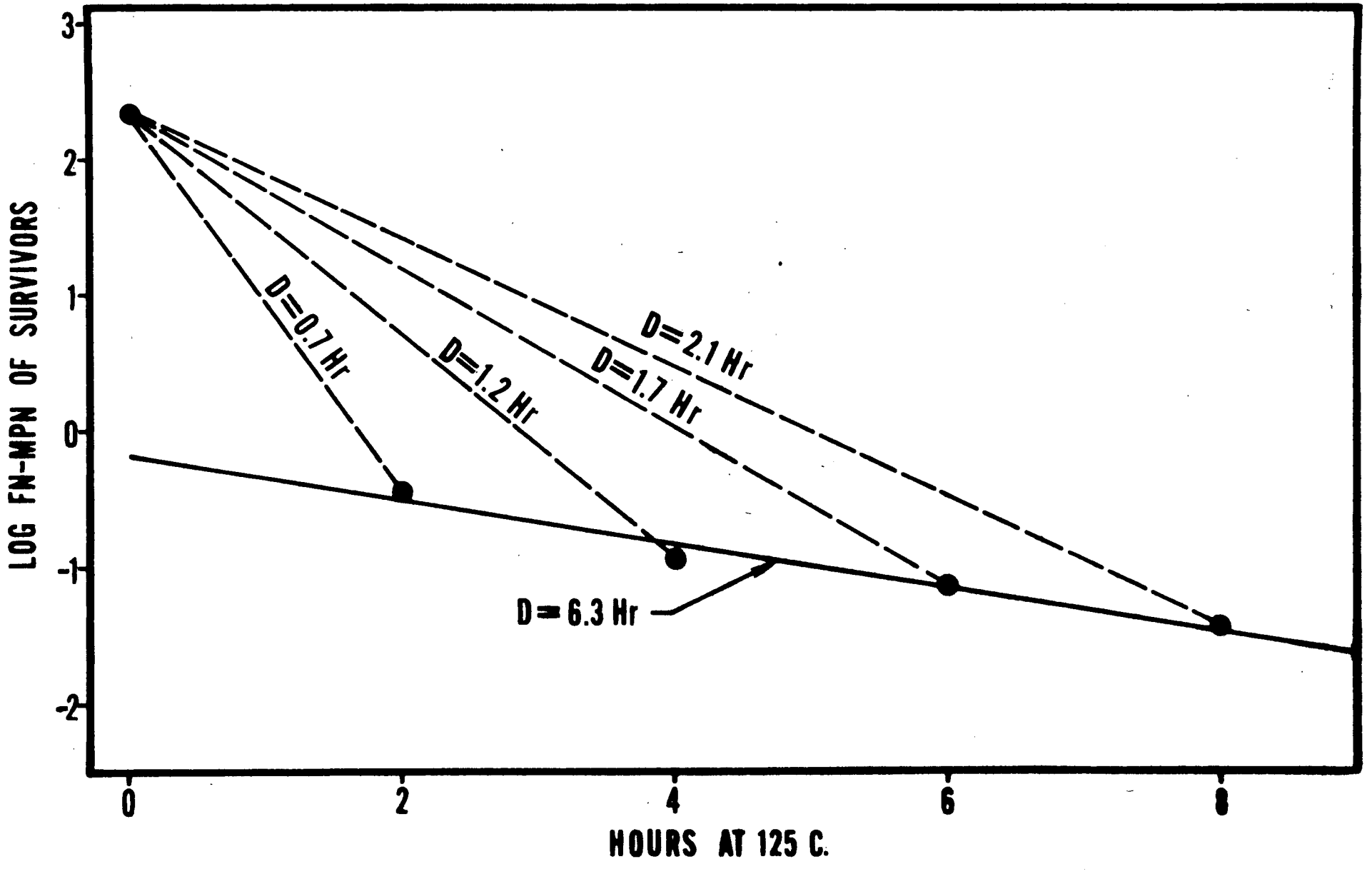

FIGURE 3. D_{113C} VALUES FOR NATURALLY OCCURRING AIRBORNE BACTERIAL SPORES ON TEFLON STRIPS EXPOSED IN THE MSOB